ACTA PARASITOLOGICA POLONICA
VOL. VIII Warszawa, 15. I. 1960 FASC. 2

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Tylodelphys podicipina sp. n. *(Trematoda, Strigeidae)* and its life-cycle

Tylodelphys podicipina sp.n. (*Trematoda, Strigeidae*) i jego cykl rozwojowy

In the course of a comprehensive research on the circulation of parasites in the biocoenosis of Lake Mamry Północne directed by late Prof. Wiśniewski in 1956—58 we found in three species of *Podiceps: Podiceps cristatus* (L.), *P. griseigena* (Bodd.) and *P. nigricollis* (Brehm) flukes of the genus *Tylodelphys.* We called these flukes *Tylodelphys podicipina* sp.n. They are common in Lake Mamry.

A metacercaria not described before we found very often in the eyes of *Perca fluviatilis* L., *Acerina cernua* (L.) and *Lota lota* (L.) in many of the Mazurian Lakes, particularly in Mamry Północne. We succeeded in finding out experimentally that it was the larval form of *Tylodelphys podicipina* sp.n.

Description of the mature form

Body tongue-shaped (Fig. 1 a. 2). Division into fore and hind segments poorly accentuated. Fore segment somewhat narrowed near ventral sucker. Hind segment curving towards dorsal side, conical in shape and tapering towards end (Fig. 2). Ventral sucker lying somewhat behind middle of fore segment. Back part of fore segment occupied by holdfast organ, oval, spherical or transversely oval, depending on its contraction. Opening of holdfast organ slit-like, sometimes wide open.

Oral sucker protruding forward and always smaller than ventral in unflatened specimens. Two large lateral suckers on both sides of oral sucker. Edges of lateral suckers either flat or concave,

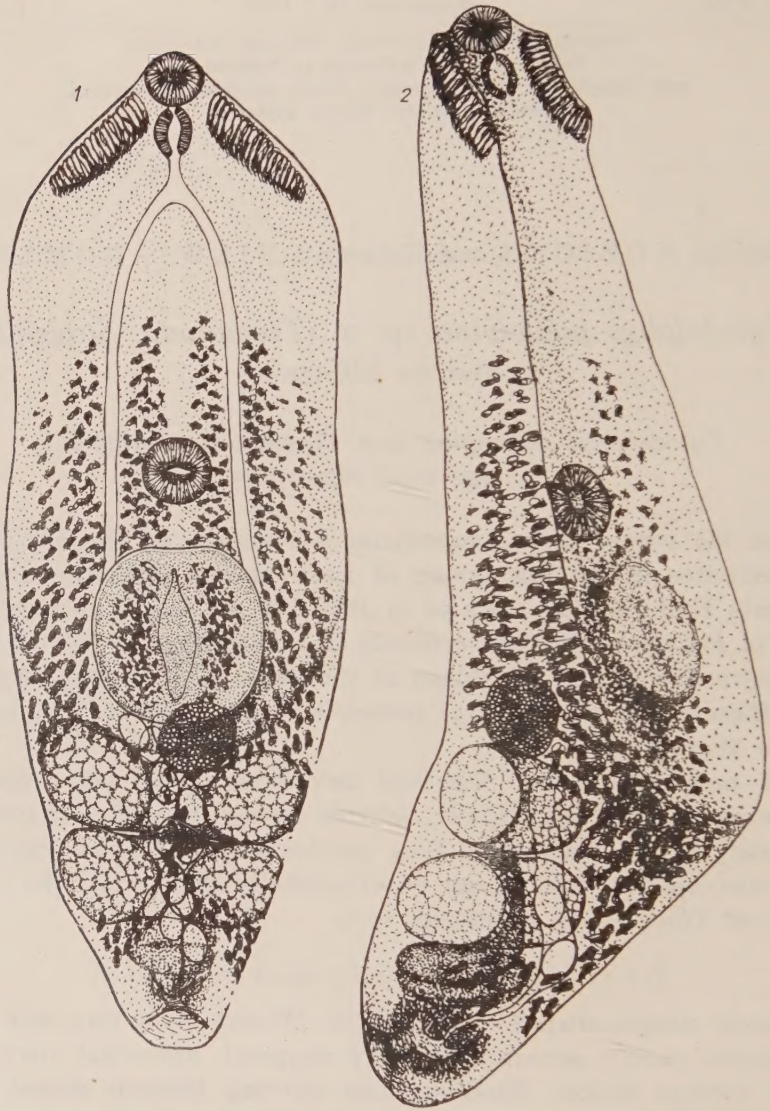

Fig. 1 a. 2 Adult *Tylodelphys podicipina* sp.n. from *Podiceps cristatus* (L.)

sometimes slightly convex, may reach above oral sucker. Praepharynx very short. Pharynx almost as long as oral sucker. Oesophagus short. Intestinal coeca extending towards back of body and disappearing under vitellaria near holdfast organ.

Testes curved like horse-shoe occupying two thirds of hind segment. Vas deferens running in hollow of testes and passing into

wide vesicula seminalis behind testis. Ovary on border of segments, left, and shifted closer to dorsal side of body. Uterus running backwards in hollow of testes, closer to ventral side of body than vas deferens. Terminal part of uterus connected with ductus ejaculatorius as short hermaphroditic canal emptying on the end of small conus genitalis into bursa copulatrix. Opening of bursa copulatrix shifted on to dorsal side. Vitellaria forming six stripes in fore segment. Lateral stripes not so well developed. Vitellaria reaching half way between intestinal coeca and ventral sucker, and sometimes even farther forward, in sexually mature forms containing many eggs; and somewhat before ventral sucker in juvenile forms. Vitellaria surrounding adhesive organ in back of fore segment, passing on to ventral side at the same time and forming one stripe in hind segment, running backwards and forking half way through hind testis into two branches surrounding vesicula seminalis. Vitelline vesicle between testes. Uterus filled with pretty large eggs, up to 80 in number, usual number being 10. Number of eggs depending on age of fluke and time it is kept alive in water before it is preserved. Outlines of main excretory ducts visible in fore segment.

We present measurements of specimens preserved in 75% alcohol, unflattened, coloured with alum carmine and kept in Canada balsam. The figures in brackets stand for the largest measurements of flattened specimens.

Measurements of 20 specimens were taken.

Length of body	1.40 — 1.90 (2.28) mm
Length of fore segment	0.98 — 1.33 (1.40) mm
Width of fore segment	0.34 — 0.57 (0.76) mm
Length of hind segment	0.41 — 0.66 (0.98) mm
Width of hind segment near first testis	0.26 — 0.49 (0.76) mm
Oral sucker	60 — 80 (110) × 80 — 100 (124) μ
Pharynx	64 — 72 × 52 — 72 μ
Oesophagus	20 — 60 μ
Ventral sucker	80 — 124 (150) × 100 — 120 (124) μ
Holdfast organ	220 — 304 (450) × 190 — 304 (513) μ
Ovary	132 × 180 μ
Length of lateral suckers	0.160 — 0.210 (0.220) mm
Testis I	0.14 — 0.18 (0.24) × 0.47 — (0.68) mm
Testis II	0.12 — 0.16 (0.20) × 0.38 — (0.53) mm
Eggs	80 — 88 × 52 — 64 μ
Number of eggs	sometimes to 80; usually ± 10

Hosts: *Podiceps cristatus* (L.), *P. griseigena* (Bodd.), *P. nigricollis* (Brehm).

Habitat: small intenstine.

Geographical distribution: Mazury, Poland.

Description of metacercaria and its development in natural invasion

Body tongue-shaped (Fig. 3), somewhat concave on ventral side, somewhat rounded in front, somewhat narrower and pointed towards back. Hind part of body, small tail, much thinner than fore part of body adjoining it, easily retractable and extendable. Oral sucker not very large. Praepharynx short. Pharynx elliptical, distinct. Oesophagus reaching 1½ length of pharynx. Caeca not reaching end of body, widening towards end and terminating behind holdfast organ. Ventral sucker larger than oral, about half way through body. Lateral suckers almost invisible. Holdfast organ opening with medially situated slit. Excretory vesicle Y-shaped; its lateral branches large, its medial branch very short. Anlages of gonads in fork of vesicle. Excretory bodies oval, strongly refrangent, filling up body in older specimens, making it even more opaque. Cuticle thick. Muscles well developed. Stripes of longitudinal muscles appearing very distinctly in stained preparations as characteristic parallel stripes.

Metacercariae move quickly by contracting and extending. When extending they become club-like and are thicker at the front and thinner at the back of the body. When fully extended they are up to 3 mm long. Their colour is whitish, their body opaque and massive. They settle in the vitreous humour and the fluid of the eye. They have never been found in the lens.

Measurements were taken of 20 flattened metacercariae preserved in 75° alcohol, stained with alum carmine and kept in Canada balsam.

		Average measurement
Length of body	1.14 — 1.82 mm	1.45 mm
Width of body	0,34 — 0.57 mm	0.49 mm
Oral sucker	52 — 80 × 60 — 72 μ	59 × 58 μ
Pharynx	32 — 52 × 26 — 40 μ	40 × 32 μ
Ventral sucker	72 — 104 × 72 — 104 μ	95 × 88 μ
Holdfast organ	190 — 300 × 105 — 190 μ	212 × 144 μ

The structure of the metacercaria corresponds to the features of the larval genus *Tylodelphys* as given by Lühe (1909) and Dubois (1938). It coincides with that of *Tylodelphys clavata*

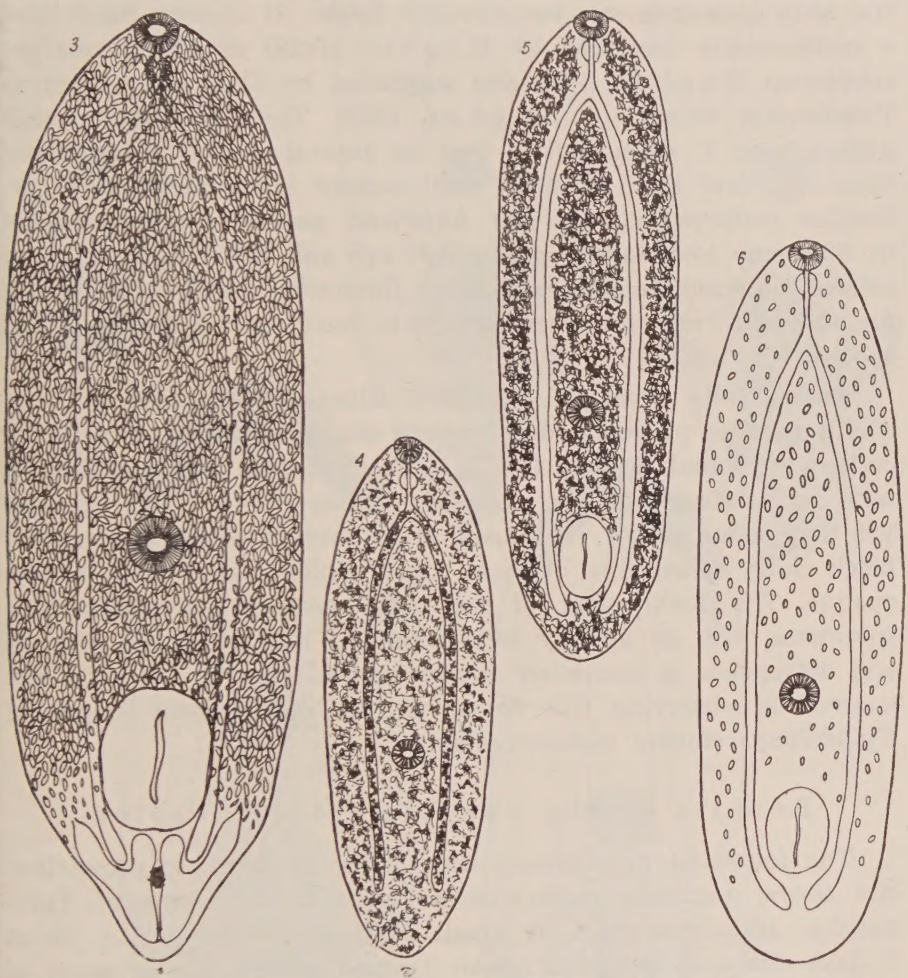

Fig. 3. — *T. podicipina* metacercaria from the eye of *Perca fluviatilis* L.; Fig. 4-6. — Successive development stages of *T. podicipina* metacercaria in the eye of *Lota lota* (L.) in natural invasion.

(Nordmann, 1832) Diesing, 1850, a typical representative of this genus, in such generic features as the form of the body, the form of excretory vesicle and poorly developed lateral suckers as well as the site of the ventral sucker between the middle and the hind extremity of the body and the elliptical shape of the

excretory bodies. On the other hand, the new metacercaria differs from it in the measurements of its suckers being in the inverse ratio, the medial part of its excretory vesicle being shorter and the body measurements considerably larger. It is very much like a metacercaria described by Hughes (1929) as *Diplostomulum scheuringi* Hughes, 1929 and suggested by Dubois (1938) as *Tylodelphys scheuringi* (Hughes, 1929). The new metacercaria differs from *T. scheuringi* in that its ventral sucker is far larger than oral and that its body and suckers are somewhat larger. Similar features between the American and our species consist in the same localization in the fish eye and their appearance in related intermediate species — *Perca fluviatilis* L. and *Lota lota* (L.) for ours and *Perca flavescens* and *Lota maculosa* for the American species.

Among fully developed specimens filled up with excretory bodies a number of young development stages of the new metacercaria were found in *Lota lota* (L.) The youngest of them (Fig. 4) with no holdfast organ or excretory bodies are thin and delicate, yet they move pretty vigorously. It is easy to notice the greyish black clotty consistence of their bodies which makes them almost opaque. The dark colour of the body becomes more intense in specimens with an already well-developed holdfast organ (Fig. 5) and disappears as excretory bodies appear (Fig. 6). We did not succeed in observing this colour in the development stages of *Tylodelphys clavata* metacercariae.

Results of the experimental invasion

The following experiments were made in order to prove that the above described metacercariae were larval forms of *Tylodelphys podicipina* sp.n. A small *Podiceps cristatus* (L.), about 7 days old was caught at Lake Drużno, where the invasion of fish by these metacercariae is very faible (Kozicka in litt.). The bird was fed on fish muscles and liver for about three weeks and then invaded with 51 metacercariae from the eye of *Perca fluviatilis* L.; it was fed the metacercariae in two doses at an

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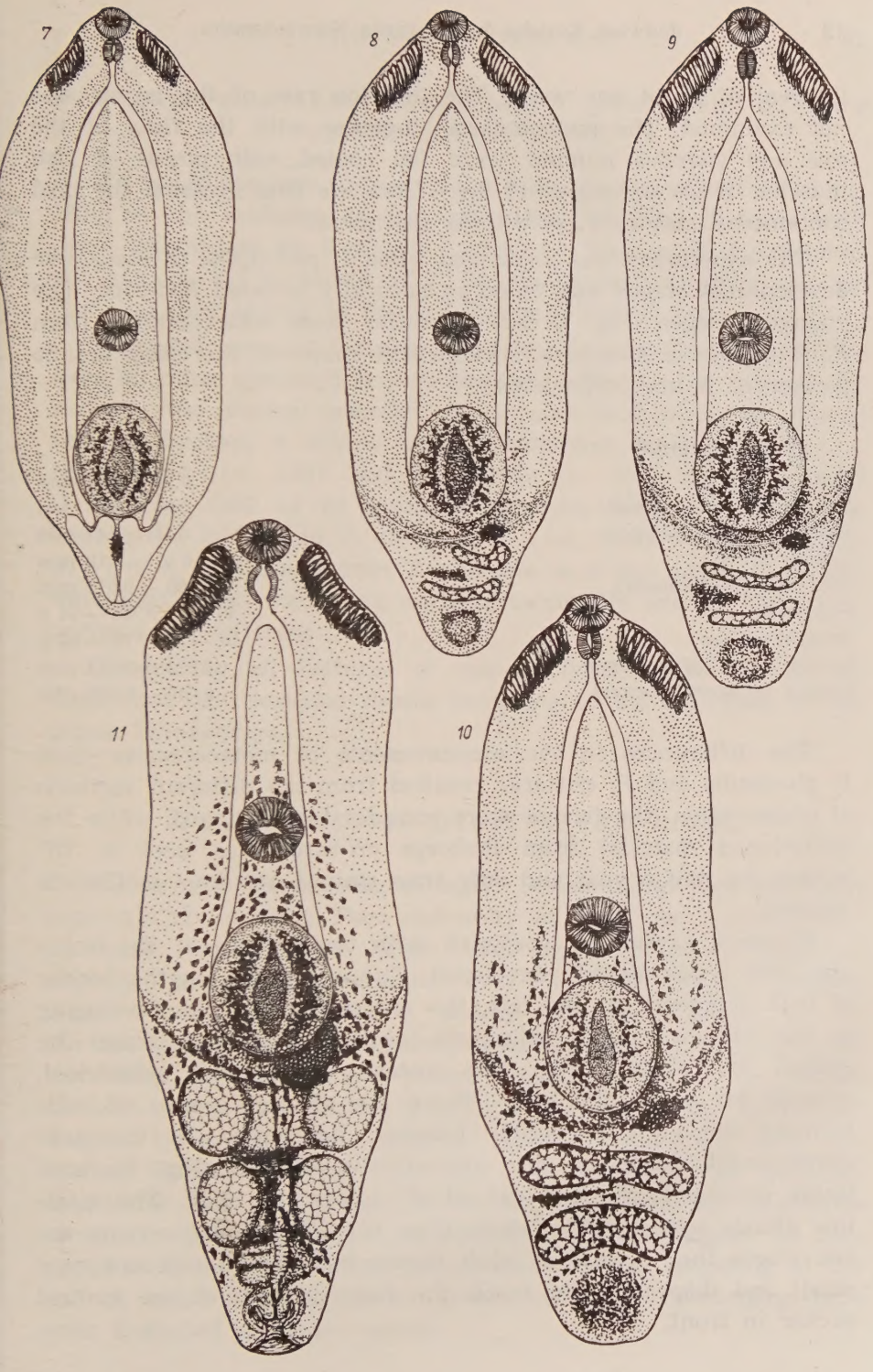
Fig. 7-11. — Successive development stages of *T. podicipina* sp.n. in naturally invaded *Podiceps cristatus*.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interval of about one week. The invasion rate of the larvae was not examined. The metacercariae together with the fluid of the eye and vitreous humour were fed coated with pieces of fish muscles. When examined 17 days from the first invasion the bird contained 8 mature *T. podicipina* specimens.

The experiment was confirmed when *T. podicipina* in successive development stages was found in naturally invaded *Podiceps*. The youngest stages (Fig. 7) did not differ from metacercariae from *P. fluviatilis* in structure, suckers and shape of excretory vesicle (preserved in one preparation).

Measurements:

Length of body	0.95 — 1.12 mm
Length of fore segment	0.87 — 0.98 mm
Width of fore segment	0.34 — 0.41 mm
Length of tail	0.07 — 0.19 mm
Oral sucker (diameter)	0.060 — 0.072 mm
Pharynx	40 — 44 × 36 — 44 μ
Ventral sucker	64 — 88 × 76 — 88 μ
Length of holdfast organ	0.192 — 0.212 mm
Length of lateral suckers	0.080 — 0.092 mm

The differences in the measurements of metacercariae from *P. fluviatilis* and *P. cristatus* resulted from the different methods of preservation (the former were considerably flattened, while the unflattened material from *Podiceps cristatus* was kept in 75° alcohol for half a year and only then stained and kept in Canada balsam).

Figure 8 presents a specimen with the anlages of the ovary and both testes already developed. The ovary lies on the border of both segments on the left, the anterior testis also developing on the left as a small rolling-pin reaching somewhat behind the central line of the body. The posterior testis, also cylindrical, extends all across the body. There are distinct groups of cells forming the vitelline vesicle between the testes. In the next development stage of the reproductive organs (Fig. 9), both testes become larger and extend all across the body. The vitelline glands appear rather early (Fig. 10) and at once occupy the site where they appear in adult forms; but the follicles are very small and dispersed and reach the front margin of the ventral sucker in front.

Discussion of the taxonomic position of the species described

We assign the new species to the genus *Tylodelphys* Diesing, 1850 on the evidence of the coincidence of most features with those established by Dubois (1938) for the genus *Tylodelphys* and also on the structure of *T. podicipina* metacercariae and the fact that they belong to the larval genus *Tylodelphys*.

The most essential features in which *T. podicipina* sp.n. differs from all other species described before are the inverse ratio of the suckers (the ventral usually larger) and well-developed lateral suckers. Besides, it differs from *Tylodelphys conifera* (Mehlis, 1846) Dubois, 1937 and *T. clavata* (v. Nordmann, 1832) Diesing, 1850 as its measurements are large and its ovary lies on the left [as in *T. elongata* (Lutz, 1928) = *T. americana* (Dubois, 1936)], and from *T. elongata* as it has no clear-cut and wide-open bursa copulatrix opening terminally and its body proportions are different.

Considering all features of the newly described species we think that new features should be added to the definition of the genus *Tylodelphys*.

Genus *Tylodelphys* (Diesing, 1850) emend.

Flukes with tongue-shaped body. Division into fore and hind segments not distinct. Fore extremity of body not distinctly trichotomic. Oral sucker larger than ventral. Lateral suckers, slightly protruding, sometimes very well developed. Holdfast organ round, almond-shaped, widely oval or elliptical, 1/3 to 1/6 the length of fore segment, opening with medially situated slot. Hind segment conical. Ovary lying laterally on the border of both segments. Testes developed symmetrically, horseshoe-shaped, lying ventrally. Anterior testis always wider than posterior. Testes occupying the front two thirds of hind segment, sometimes less. Bursa copulatrix with subterminal, sometimes terminal, opening. Short hermaphroditic canal, formed by terminal section of uterus and ductus ejaculatorius, emptying at the end of small conus genitalis. Metacercariae of *Tylodelphys*-type with Y-shaped excretory vesicle.

Well-developed lateral suckers and the oral-to-ventral-sucker relation untypical of the previous description of the genus *Tylodelphys* made it necessary for us to compare our specimens with those of the genus *Glossodiplostomum* D u b o i s, 1932 found

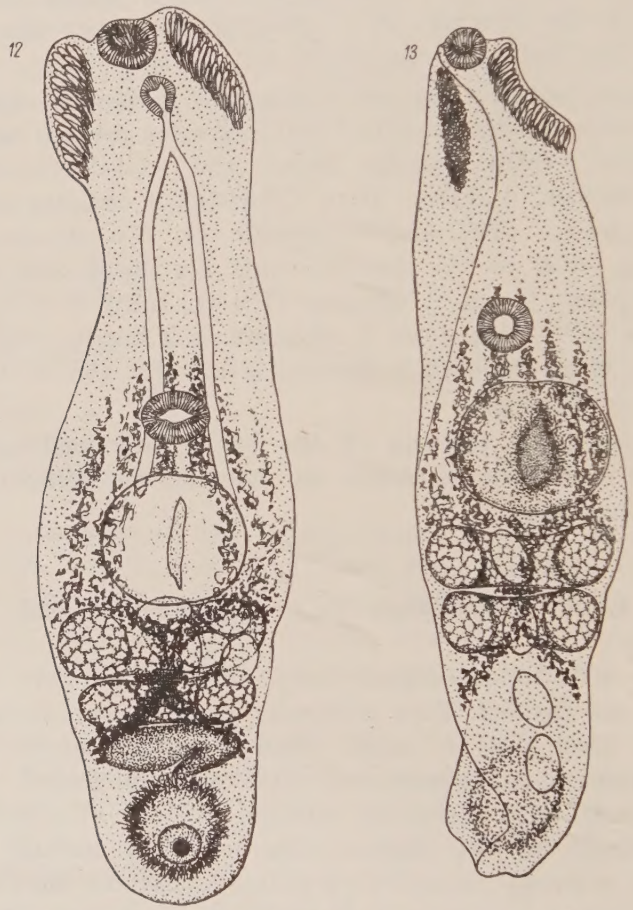

Fig. 12 a. 13. *Glossodiplostomum glossoides* (D u b o i s, 1928).
12 — type; 13 — cotype.

in *Colymbus arcticus* L. By the courtesy of Dr. G. D u b o i s, to whom we offer thanks for the preparation he had sent us, we were in a position to compare the type and cotype of *Glossodiplostomum glossoides* (D u b o i s, 1928) with our material — Fig. 12 a. 13. The structure of „glandes prosdétiques" of the cotype of *Gl. glossoides* is

identical with that of the *T. podicipina* lateral suckers (the same in all *Diplostomini*). The oral-to-ventral-sucker relation (particularly in the cotype, the ventral sucker of which is far larger), the shape of the holdfast organ, the horseshoe-like structure of the testes, the arrangement of the vitelline glands and the presence of a small conus genitalis are all similar in both species. Other features, such as the shape of the hind extremity of the body viewed laterally and the position of the ovary are difficult to observe in flattened *Gl. glossoides* preparations. *Glossodiplostomum glossoides* differs from *Tylodelphys podicipina* sp.n. in that it has a rounded hind segment, larger eggs, a larger bursa copulatrix, a relatively large holdfast organ and smaller testes occupying about a half of the hind segment. These features, while distinguishing *Glossodiplostomum glossoides* from *Tylodelphys podicipina* sp.n. do not exceed the taxonomical framework of the genus *Tylodelphys* as we describe it.

Considering the far-going similarity between *Gl. glossoides* (Dubois, 1928) and *T. podicipina* sp. n. and the fact that the coinciding features in both species are at the same time characteristic of the genus *Tylodelphys* we think it legitimate to transfer *Gl. glossoides* to the genus *Tylodelphys* as *Tylodelphys glossoides* (Dubois, 1928) comb. nov.

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STRESZCZENIE

Nowy gatunek przywry — *Tylodelphys podicipina* sp.n. znaleziony był na jeziorze Mamry u *Podiceps cristatus* (L.), *P. griseigena* (Bodd.) i *P. nigricollis* (Brehm).

W ciałku szklistym i płynie oka *Perca fluviatilis* L., *Lota lota* (L.) i *Acerina cernua* (L.) znaleziono nieznaną w literaturze metacerkarię, która, jak wykazał eksperyment, jest formą larwalną *T. podicipina* sp.n.

Autorki podają opis formy dorosłej *T. podicipina* sp.n., opis metacerkarii i jej rozwój w oku *Lota lota* (L.), oraz rozwój postaci dorosłej u *Podiceps cristatus* (L.).

Na podstawie cech charakterystycznych dla nowego gatunku, autorki rozszerzają charakterystykę rodzaju *Tylodelphys*. Nowa charakterystyka rodzaju wykazuje cechy wspólne z rodzajem *Glossodiplostomum* Dubois, 1932. Po przeanalizowaniu cech obu rodzajów i po porównaniu *Glossodiplostomum glossoides* (Dubois, 1928) z *Tylodelphys podicipina* sp.n., autorki uważają za słuszne włączenie *Gl. glossoides* do rodzaju *Tylodelphys* jako *Tylodelphys glossoides* (Dubois, 1928) comb. nov.